

# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

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<b>Hatchery Program:</b>	Chimacum Creek Summer Chum Salmon Reintroduction
<b>Species or Hatchery Stock:</b>	Summer chum salmon, <i>Oncorhynchus keta</i> , Salmon Creek stock
<b>Agency/Operator:</b>	Washington Department of Fish and Wildlife / Wild Olympic Salmon
<b>Watershed and Region:</b>	Chimacum Creek, Admiralty Inlet, Puget Sound, Washington State
<b>Date Submitted:</b>	February 28, 2000
<b>Date Last Updated:</b>	March 26, 2001

## **SECTION 1. GENERAL PROGRAM DESCRIPTION**

**1.1) Name of hatchery or program.** Chimacum Creek summer chum salmon reintroduction

**1.2) Species and population (or stock) under propagation, and ESA status.**

Summer chum salmon, *Onchorhynchus keta*, Salmon Creek stock;  
Hood Canal Summer Chum ESU: Threatened

**1.3) Responsible organization and individuals**

*Indicate lead contact and on-site operations staff lead.*

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**Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:** operation expenses and Labor and Industries insurance for volunteers provided through Regional Fish Enhancement Group North Olympic Salmon Coalition (NOSC); Point No Point Treaty Council and tribes

**1.4) Funding source, staffing level, and annual hatchery program operational costs.**

Source: WDFW, NOSC, WOS.

Staffing: oversight and support provided by WDFW fish biologist, habitat biologist, fish health specialist, and Dungeness Hatchery Complex personnel; hatchery operations staffed by trained volunteers with Wild Olympic Salmon

Operational costs: ~ \$3000 for operation of Chimacum Creek Hatchery; plus additional costs for WDFW staff time (estimate can be provided)

### **1.5) Location(s) of hatchery and associated facilities.**

Broodstock collection: at trap on Salmon Creek (WRIA 17.0245) at RM 0.2.

Dungeness Hatchery: located on Dungeness River (WRIA 18.0018) at RM 10.6; eggs and milt transported to Dungeness Hatchery for fertilization, initial incubation, and otolith marking; eyed eggs transported to Chimacum Creek Hatchery.

Chimacum Creek Hatchery: located on a tributary to Naylor Creek (WRIA 17.02xx), tributary to Chimacum Creek (17.0203) at RM 4.5, tributary to Port Townsend Bay, Puget Sound; egg incubation, hatching, and initial rearing.

### **1.6) Type of program.**

Integrated Recovery

### **1.7) Purpose (Goal) of program.**

Restoration. The goal of this program is to reintroduce an extirpated summer chum salmon population to Chimacum Creek using the Salmon/Snow stock; and to restore a healthy, natural, self-sustaining population of summer chum salmon in Chimacum Creek that will maintain the genetic characteristic of the native stock. This reintroduction shall represent a range extension of the Salmon/Snow stock.

### **1.8) Justification for the program.**

Chimacum Creek summer chum salmon was identified as an extirpated stock and selected as a reintroduction candidate in the Summer Chum Salmon Conservation Initiative (SCSCI) developed by Washington Department of Fish and Wildlife and Point-No-Point Treaty Tribes (2000). This program is fully consistent with the rationale, intent, and implementation of the supplementation and reintroduction approach identified in the SCSCI. The following is taken from the SCSCI:

Supplementation is viewed as an effective tool, in combination with other management actions, for restoring natural production to healthy levels within the Hood Canal/Strait of Juan de Fuca summer chum ESU. By the early 1990s, summer chum populations had declined to such low levels that the risk of extinction to portions of the ESU on the short term was high. Furthermore, with the recent extirpation of four populations, the need for hatchery-based actions was identified to reintroduce summer chum into vacant habitat that, based on stock assessment data, appeared unlikely to be colonized naturally within a reasonable time frame. The need to quickly boost the population sizes above critically low levels, and the fact that some factors limiting production, such as harvest and habitat degradation, were in the process of being addressed also contributed to the decision to use supplementation.

The intent of supplementation efforts within this ESU is to reduce the short term extinction risk to existing wild populations and to increase the likelihood of their

recovery to a healthy status. These objectives can be accomplished through the establishment of supplemented populations using indigenous brood stock, and through reintroduction of appropriate populations into streams now lacking summer chum. In keeping with the intended ephemeral nature of this form of artificial production, the proposed supplementation strategy will be limited in duration and designed to help maintain the populations while potential factors for decline are identified and being addressed. Monitoring and evaluation activities proposed for the programs will provide important new scientific information regarding the effectiveness of supplementation as it relates to chum salmon. Contribution to the re-establishment of naturally functioning ecosystems through the recovery or restoration of summer chum populations, is also an intent.

The supplementation focus at this time is on recovery of “at risk” stocks and reintroduction of extirpated populations. This current emphasis is in response to the generally poor condition of the stocks within the ESU. For “at risk” populations chosen through this program for supplementation, hatchery production of fed fry of large size relative to natural fry, released at the proper migration time, will provide a survival advantage that will improve the status of the populations more rapidly than is possible through natural production alone. The immediate objective for these populations will be to boost the population abundance as quickly as possible, increasing natural spawner densities to sustainable levels that will alleviate the risk of extinction to the populations. For selected, extirpated populations, seeding of usable habitats will be accomplished through reintroduction strategies developed specifically for each recipient watershed. Reintroduction planning strategies will include selection of the most appropriate donor stock, acclimation to the recipient location, and release of fed chum fry to maximize the likelihood for the establishment of a population.

### **1.9) List of program “Performance Standards”.**

The following are objectives for the re-establishment of a summer chum population in Chimacum Creek, as presented in the SCSCI (WDFW and PNPTT 2000):

- 1) release a maximum of 86,000 Salmon Creek-origin fry reared on Chimacum Creek into the lower watershed or the immediate estuary, and monitor adult returns from the initial releases and evaluate the natural spawning success of these adults, where success is measured by return of the naturally produced adult offspring;
- 2) develop and maintain, for up to 12 years, a population comprised of supplemented and naturally spawning fish using hatchery and wild-origin broodstock;
- 3) monitor, evaluate and annually report the effectiveness of the reintroduction

program, as measured by consistency with criteria set forth in the SCSCI.

**1.10) List of program “Performance Indicators”, designated by "benefits" and "risks."**

This program is fully consistent with the intent and implementation of the monitoring and evaluation component for supplementation and reintroduction programs identified in the SCSCI. The monitoring and evaluation program in the SCSCI responds to concerns regarding the uncertainty of summer chum supplementation and reintroduction effects by addressing the following four elements :

1. The estimated contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process;
2. Changes in the genetic, phenotypic, or ecological characteristics of populations (target and non-target) affected by the supplementation/reintroduction program;
3. The need and methods for improvement of supplementation/reintroduction activities in order to meet program objectives, or the need to discontinue a program because of failure to meet objectives; and
4. Determination of when supplementation has succeeded and is no longer necessary for recovery.

**1.10.1) “Performance Indicators” addressing benefits.**

**Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.**

1. Differentially mark all hatchery-origin summer chum fry to allow for distinction from natural-origin fish upon return as adults on the spawning grounds. This will be accomplished by otolith (thermal) marking or another permanent, effective method.
2. Conduct spawning ground surveys throughout the summer chum return to enumerate spawners, and to collect information regarding fish origin (via random sampling of fish heads for otoliths), and age class composition through scale sampling.
3. Estimate the number of naturally spawning hatchery-origin summer chum contributing to each supplemented population’s annual escapement.

**Element 4: Collect and evaluate information on adult returns.**

1. Commencing with the first year of returns of progeny from naturally-spawned, hatchery-origin summer chum, evaluate results of spawning ground surveys and age class data collections to:
  - a. Estimate the abundance and trends in abundance of spawners;
  - b. Estimate the proportion of the escapement comprised by chum of hatchery lineage, and of wild lineage;
  - c. Through mark sampling, estimate brood year contribution for hatchery lineage and wild-origin fish.

Using the above information, determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and wild proportions will be determined by implementation plans, budgets, and assessment priorities.

**1.10.2) “Performance Indicators” addressing risks.**

**Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.**

1. Monitor escapements of non-supplemented populations to determine the level of straying of supplementation program-origin fish to other drainages.

**Element 2: Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations presently affected by the supplementation program.**

1. Collect additional GSI data (allozyme or DNA-based) from regional summer chum adult populations to determine the degree to which discrete populations exist in the individual watersheds.
2. Continue GSI allozyme collections of summer chum spawners throughout the region for comparison with past collections to monitor changes in allelic characteristics, and with the intent to assess whether the supplementation program has negatively affected the genetic diversity of natural populations.
3. Continue collecting and archiving DNA samples for future analysis.

**Element 3: Determine the need, and methods, for improvement of supplementation or reintroduction operations or, if warranted, the need to discontinue the program.**

1. Determine the pre-spawning and green egg to released fry survivals for each program at various life stages.
  - a. Monitor growth and feed conversion for summer chum fry.
  - b. Determine green egg to eyed egg, eyed egg to swim-up fry, and swim-up fry to released fry survival rates for summer chum.
  - c. Maintain and compile records of cultural techniques used for each life stage, such

as: collection and handling procedures, and trap holding durations, for chum broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for fed fry.

- d. Summarize results of tasks for presentation in annual reports.
  - e. Identify where the supplementation program is falling short of objectives, and make recommendations for improved fry production as needed.
2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.
- a. Monitor operation of adult trapping operations, ensuring compliance with established broodstock collection protocols for each station.
  - b. Monitor timing, duration, composition, and magnitude of each run at each adult collection site.
  - c. Maintain daily records of trap operation and maintenance (e.g. time of collection), number and condition of fish trapped, and environmental conditions (e.g. river stage, tide, water temperature).
  - d. Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible.
  - e. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.
3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW (or USFWS for federal agency operations) will monitor fish health.
- a. Fish health monitoring will be conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.
  - b. The incidence of viral pathogens in summer chum broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the "Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998).
  - c. Recommendations on fish cultural practices will be provided on a monthly basis, based upon the fish health condition of chum fry.
  - d. Fish health monitoring results will be summarized in an annual report.

**Element 4: Collect and evaluate information on adult returns.**

This element will be addressed through consideration of the results of previous "Elements 1., 2., and 3.", and through the collection of information required under adaptive criteria that will be used as the basis for determining when to stop a supplementation or reintroduction program.

1. Collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock used in each supplementation program for use as baseline data to document any phenotypic changes in the populations.

2. Compare newly acquired electrophoretic analysis data reporting allele frequency variation of returning hatchery and wild fish with baseline genetic data. Determine if there is evidence of a loss in genetic variation (not expected from random drift) that may have resulted from the supplementation program..

**1.11) Expected size of program.**

**1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).**

Summer chum propagated for this program are progeny of broodstock collected from Salmon Creek; 97 adults (39 females and 58 males) are proposed for this project. No broodstock are proposed to be collected from Chimacum Creek for spawning at the present time. However, there is a potential that a collection strategy will be proposed in future years, pending the duration of the donor Salmon Creek program, and the success in establishing a self-sustaining return of summer chum in Chimacum Creek over the next few years.

**1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.**

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry	Chimacum Creek	86,000
Fingerling		
Yearling		

**1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.**

In 1999, an estimated thirty-eight (38) age 3 summer chum adults returned to Chimacum Creek from the initial 1996 brood year reintroduction release. In 2000, estimated escapement was 52 summer chum adults in Chimacum Creek, comprised of 11.4% age 2, 51.4% age 3, and 37.1% age 4 fish (pers. comm., T. H. Johnson, WDFW).

**1.13) Date program started (years in operation), or is expected to start.**

Initiated with brood year 1996.

**1.14) Expected duration of program.**

This program is fully consistent with the standards presented in the SCSCI. Expected maximum duration is three generations (12 years); 8 years remaining

**1.15) Watersheds targeted by program.**

Chimacum Creek (WRIA 17.0203).

**1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.**

Alternative actions considered and implemented include integration with habitat and harvest recovery measures identified in the SCSCI.

**SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.**

**2.1) List all ESA permits or authorizations in hand for the hatchery program.**

None in hand; ESA listings are new in this area.

**2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.**

**2.2.1) Description of ESA-listed salmonid population(s) affected by the program.**

The following is paraphrased from life history information for Hood Canal and Strait of Juan de Fuca summer chum presented in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000):

Hood Canal and Strait of Juan de Fuca summer chum populations are one of three genetically distinct lineages of chum salmon in the Pacific Northwest region; and were designated as an evolutionarily significant unit (ESU) based upon distinctive life history and genetic traits. The uniqueness of the summer chum life history is best characterized by their late summer entry into freshwater spawning areas, and their late winter/early spring arrival in the estuaries as seaward-migrating juveniles. Reproductive isolation has been afforded by a significantly different migration and escapement timing and geographic separation from other chum stocks.

Summer chum spawning occurs from late August through late October. Eggs eye in redds after about 4 to 6 weeks incubation and hatch about 8 weeks after spawning. Fry emerge from redds, usually with darkness, between February and late May and immediately commence migration downstream to estuarine areas. Summer chum fry initially inhabit nearshore areas and occupy sublittoral seagrass beds for about one week and are thought to be concentrated in the top few meters of the water column both day and night. Upon reaching a size of 45-50 mm, fry move to deeper offshore areas. Migrating at a rate of 7-14 km per day, the southernmost outmigrating summer chum fry population in Hood Canal would exit the Canal 14 days after entering seawater (90% of population exits by April 28 each year, on average); and Strait of Juan de Fuca summer chum would exit the Discovery Bay area 13 days after entering seawater (90% completion by June 8 each year, on average).

Summer chum mature primarily at 3 and 4 years of age. The southerly ocean migration down the Pacific Northwest coast from rearing areas in the northeast Pacific Ocean likely commences in mid-July and continues through at least early September. Adults enter terminal areas from early August through late September, with spawning ground entry timing in Hood Canal from late August through mid-October and in Strait of Juan de Fuca from early September through mid-October. Hood Canal and Strait of Juan de Fuca summer chum typically spawn soon after entering freshwater in the lowest reaches of natal streams. Low summer-time flows likely have acted to confine summer chum spawning in this region to the lowest reaches.

**- Identify the ESA-listed population(s) that will be directly affected by the program.**

The program will lead to recovery of Chimacum Creek summer chum salmon which is a stock identified as part of the Hood Canal Summer Chum ESU.

**- Identify the ESA-listed population(s) that may be incidentally affected by the program.**

The program may incidentally affect chinook salmon in the Puget Sound Chinook ESU (by providing additional prey base for chinook). It is not anticipated that the program will impact bull trout since none are known to be present in the area of the program.

**2.2.2) Status of ESA-listed salmonid population(s) affected by the program.**

**- Describe the status of the listed natural population(s) relative to “critical” and “viable” population thresholds.**

In the SCSCI, the Snow/Salmon Creek summer chum stock is identified as “depressed” due to chronically low escapements. In addition, a risk assessment using procedures for measuring extinction risk as presented by Allendorf et al. (1997) was done and the current risk of extinction was judged to be low. However, at the time supplementation was initiated in 1992, this stock would have been judged to be at high risk of extinction.

In the SCSCI, the Chimacum Creek summer chum stock is identified as “extinct” since no summer chum have been observed since the mid-1980's.

**- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.**

Data are not presently available for the natural population, but are being collected.

**- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.**

Source of natural spawning abundance data is SCSCI (for 1987 through 1998) and WDFW files (for 1999 and 2000); does not include adults collected for broodstock from 1992 through 2000 (see 7.4.2):

	<u>Salmon Creek</u>	<u>Snow Creek</u>	<u>Chimacum Creek</u>
1987	1062	465	---
1988	1915	723	---
1989	194	21	---
1990	245	33	---
1991	172	12	---
1992	371	21	---
1993	397	11	---
1994	137	2	---
1995	538	25	---
1996	785	160	---
1997	724	67	---
1998	1023	27	---
1999	434	29	38
2000	710	30	52

**- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.**

1999 and 2000: presumed 100% hatchery-origin from reintroduction program

**2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.**

**- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.**

On Salmon Creek, listed summer chum salmon adults will be trapped and collected for broodstock from August through October and result in a take. Other listed summer chum adults will be trapped, handled, and passed upstream during trap operation and may lead to injury to listed fish through delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation. The trap is located on private property, accessed through three gates maintained by the property owner. Human disturbance or poaching of summer chum held in the trap have not been experienced during the duration of operation. Chinook salmon are not indigenous to Salmon Creek or Chimacum Creek, and

takes of listed chinook are not anticipated through the broodstock collection program. Any straying chinook salmon encountered in the trap will be passed by hand upstream daily, above the weir, with minimal delay.

Incubation and rearing of summer chum from September through April has a high potential to take listed summer chum due to natural mortality causes and due to fish culture activities and conditions which affect fish health and development including handling procedures, fertilization procedures, water temperature, water quality, water flow, feeding success, and transport and/or transition from fresh to saltwater environments. Risk aversion measures minimize the likelihood for the take of listed summer chum (see 5.8). No take of other listed salmonids due to these activities is anticipated.

Physical harm of reared summer chum at release (March through May) due to descaling or increased susceptibility to predation at release has a potential to take listed summer chum, but has been minimal to date. No take of other listed salmonids is anticipated.

The contact with summer chum during spawner escapement surveys (August through October), carcass recovery programs (September and October), and other monitoring and evaluation programs has a potential to take listed summer chum, but care is taken not to harm, harass or otherwise disturb summer chum spawners.

**- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.**

A supplementation program was initiated on Salmon Creek in 1992 and a reintroduction program was started on Chimacum Creek in 1996. Since initiation of the programs (1) the number of summer chum adults trapped, handled, collected on Salmon Creek for broodstock, and/or released upstream has ranged from 100 to 1000 fish each year; (2) the number of fry released has ranged from 2,000 to 72,000 fish each year in Salmon Creek and has ranged from 28,000 to 70,000 fish each year in Chimacum Creek; and (3) the mortality during the incubation and rearing stages has ranged from 1800 to 25,400 fish each year in Salmon Creek and has ranged from 4000 to 22,000 fish each year in Chimacum Creek. Except for a 57% loss of eggs/fry during 1992 (the first year of the program), a 92% loss of eggs/fry due to equipment failure in the Salmon Creek Hatchery during 1994 (which was corrected in 1995) and a 42% loss of eggs/fry during 1996 (the first year of the program) in the Chimacum Creek Hatchery, the routine operation of the supplementation and reintroduction program has resulted in egg to fry survivals of 87% to 98%.

**- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

Projected annual take levels are (1) 12,900 eggs or fry mortality during incubation, rearing, and release (based on 98,980 eggs, 85% survival egg to release, and 86,000 fry release); (2) 97 adults removed for broodstock from Salmon Creek for Chimacum Creek (based on 98,900 eggs, 2500 eggs/female, 1.5 males/female); (3) unintentional lethal take of 30 adults during trapping, holding prior to spawning or release (based on 2% loss of 1500 adults trapped); (4) 1373 adults associated with trapping operation where fish are captured, handled and released upstream (based on 1500 adults trapped minus broodstock and unintentional lethal take); (5) 500 adults associated with disturbance of spawners during spawner surveys, and carcass and mark recovery projects (based on multiple events and average of 1 occurrence/spawner for one-third of 1500 spawners); and (6) 300 carcasses sampled for otoliths, scales, GSI, and other biological information during spawner surveys, broodstocking, and routine monitoring and evaluation activities (based on target sample size of 300). See Table 1.

**- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

The take will be limited since the number of broodstock collected will be consistent with guidelines and protocols in the SCSCI and the number of carcasses collected will be consistent with monitoring and evaluation objectives in the SCSCI. Methods to prevent catastrophic loss during incubation, rearing, and release are in compliance with program operations and protocols in the SCSCI (which includes measures to cull surplus production) and will limit take.

## **SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES**

- 3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review Report and Recommendations* - NPPC document 99-15). Explain any proposed deviations from the plan or policies.** This program is fully consistent with the guidelines, protocols, and implementation of the co-manager's Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW et al. 2000).

- 3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.**

This HGMP is consistent with relevant standing orders and agreements. The Puget Sound Salmon Management Plan (PSSMP) is a federal court order that currently controls both the harvest management rules and production schedules for salmon in Hood Canal under the *U.S. v. Washington* management framework. The parties to the SCSCI recognize that it may be necessary to modify these plans in order to implement the recommendations that will result from the SCSCI. However, the provisions of the PSSMP will remain in effect until modified through court order by mutual agreement

- 3.3) Relationship to harvest objectives.**

The summer chum supplementation program is integrated with fisheries management measures as defined in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000). The "base conservation" fishery total harvest rate proposed under the Summer Chum Salmon Conservation Initiative is 10.8% (with a range of 3.3% to 15.3%). These rates reflect incidental fishery harvest levels in Canadian and U.S. fisheries. Actual harvest rates on summer chum produced in eastern Strait of Juan de Fuca watersheds should be lower, due to the lack of terminal area commercial fisheries directed at other species where summer chum may be incidentally taken.

- 3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.**

No directed fisheries on summer chum salmon result from adult fish produced through the Salmon Creek or Chimacum Creek programs. As noted in 3.3, above, the "base conservation" fishery total harvest rate proposed under the Summer Chum Salmon Conservation Initiative is 10.8% (with a range of 3.3% to 15.3%), but should be lower for the Salmon/Snow Creek stock and Chimacum Creek

stock. These rates reflect incidental fishery harvest levels in Canadian and U.S. fisheries. Exploitation rates on the Salmon/Snow stock have been 8.7%, 10.6%, 51.2%, 35.5%, 27.2%, 23.2%, 11.0%, 16.8%, 4.8%, 2.0%, 2.4%, and 2.6% for the years 1987 through 1998, respectively.

### **3.4) Relationship to habitat protection and recovery strategies.**

The summer chum supplementation program is integrated with habitat restoration and management measures as defined in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed. Habitat factors for decline and recovery for each watershed are described. In addition, at the ESU scale, protection and restoration strategies for each limiting factor for decline are provided. The goal of the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages.

### **3.5) Ecological interactions.**

Chum salmon have a unique relationship with other salmonid species that will generally benefit the other species. In most circumstances, because of their small size and relative abundance at out-migration, summer chum fry have a positive impact as prey for other salmonids, including chinook salmon, coho salmon, and coastal cutthroat trout. In turn, chinook and coho salmon and coastal cutthroat could negatively impact the summer chum supplementation program via predation on summer chum fry, but the risk of significant impact is likely low. Chum have not been identified as predators on other salmonids and have a low risk of negatively impacting salmonids as predators.

The supplementation program will result in an increase in the number of chum salmon carcasses in freshwater areas and provide a source of nutrients which will benefit other salmonids and non-salmonids.

Supplemented summer chum may compete for food with wild chum fry. This risk will be minimized through the release of supplemented fish at a larger size than the wild fry which should lead to niche separation in the two groups.

## SECTION 4. WATER SOURCE

### 4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Eggs taken from summer chum adults trapped in Salmon Creek are incubated to the eyed stage at WDFW Dungeness Hatchery. Water rights at the Dungeness facility allow for the withdrawal of up to 14 cfs of surface water from intakes in the Dungeness River. After eye-up, the eggs are transferred to an incubation and initial rearing facility located on a tributary to Naylor's Creek, a tributary to Chimacum Creek at approximately RM 4.5. Water required for the remainder of rearing is supplied by gravity flow from a spring-fed lake located on a tributary to Naylor's Creek. The lake is approximately 3 acres in size, with depths up to 10 feet. Water is supplied by gravity flow through buried 2" PVC pipe. The intake box is constructed of slotted aluminum screen (17" x 17" x 24") and is anchored six feet from the pond bank. Maximum flows of 60gpm through this line. A parallel line of 2" ABS flexible tubing siphons water above ground and joins the primary line at the hatchery, functioning as an ongoing and backup system. It could supply more than 30gpm. In addition, the facility is armed with a low flow triggered alarm system; a battery driven audible alarm alerts hatchery staff in the event of water supply failure. If this occurs, a conventional and 12 volt battery array is in place to supply power to a sump pump; it requires manual activation. One of the crew members lives on the parcel where the hatchery site is located, another two live less than a mile away. A phone alarm system using a professional security system company to provide 24 hour monitoring is under development. The remoteness of the location provides additional security from potential vandalism of the water supply (WOS 1999).

The spring water has lower than optimal dissolved oxygen levels for fish incubation and rearing. Multiple aeration systems have been incorporated into the plumbing design as well as a electronic aerator to bring the dissolved oxygen to 100% saturation.

Beginning with brood year 2000, some of the summer chum fry are transferred to net-pens in Port Townsend Bay for rearing to release size in estuarine waters near the mouth of Chimacum Creek.

**4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.**

Dungeness and Naylor's Creek hatchery withdrawal methods (wells, screened intakes) will not lead to injury or mortality to listed fish because the intake structures are located above natural barriers to fish migration (Naylor's Creek) or are supplied by infiltration and are adequately screened to minimize risk to listed fish (Dungeness). The Dungeness Hatchery operates under a standing NPDES permit that limits discharge effects on the environment, and requires monitoring of effluent for settleable and suspended solids. The Naylor's Creek Hatchery and associated saltwater netpens each produce a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit. The NPDES permit and low production levels will likely lead to no adverse effects on water quality from the program on listed fish.

## **SECTION 5. FACILITIES**

**5.1) Broodstock collection facilities (or methods).**

Broodstock are collected for the reintroduction program using a weir and permanent trap positioned in Salmon Creek at approximately RM 0.2. During 1992-1999, the weir was constructed of metal grating near the trap box, and metal posts and fencing material on the right bank side of the trap box. The trap box consists of a concrete structure framed by 2" x 2" pickets on the upstream end, and metal grating on the downstream end. Fish are contained in the 6' x 10' trap area through a "V" weir. During summer 2000, the weir and trap will be removed as part of a habitat recovery project designed to enhance summer chum freshwater survival. Beginning in 2000, the weir will be replaced with a temporary weir of similar dimensions constructed of wood slats and fencing materials; and the trap will be of similar dimensions with a natural gravel bottom. Captured fish are held in the box until their daily removal for spawning or passage upstream. Fish are spawned directly adjacent to the trap. Spawning is accomplished as needed beneath a temporary awning to protect the eggs and milt collected from the fish from rain. Eggs and milt are transported chilled in plastic bags and buckets by truck to Dungeness Hatchery for fertilization and loading into incubators.

No broodstock are proposed to be collected from Chimacum Creek for spawning at the present time. However, there is a potential that a collection strategy will be proposed in future years, pending the duration of the donor Salmon Creek program, and the success in establishing a self-sustaining return of summer chum in Chimacum Creek over the next few years.

**5.2) Fish transportation equipment (description of pen, tank truck, or container used).**

Eggs and milt are chilled and transported in plastic bags by truck from Salmon Creek to Dungeness Hatchery. Moist eyed eggs are transported to Salmon and Naylor's Creek Hatcherys by truck in 5 gallon buckets cushioned by foam pads. Fed fry are transported by truck or trailer in a 4' x 4' x 2.5' plastic fish tote aerated with regulated oxygen from an oxygen bottle via air stone for release at the mouth of Chimacum Creek and/or for rearing in saltwater netpens.

**5.3) Broodstock holding and spawning facilities.**

At Salmon Creek, broodstock are held in the broodstock collection trap described in 5.1, above, for about 1-2 days prior to scheduled spawning days (usually twice a week). On other days, the broodstock collection trap is checked daily and fish are passed upstream. Fish are spawned directly adjacent to the trap. Spawning is accomplished as needed beneath a temporary awning to protect the eggs and milt collected from the fish from rain.

**5.4) Incubation facilities.**

Green and eyed eggs are incubated in vertical stack incubators at Dungeness Hatchery. Eyed eggs are transferred moist, in buckets, by truck for incubation at the Naylor's Creek facility. The eggs are incubated in a vertical stack incubation unit, supplied with 2.5 - 3.5 gpm inflow drawn from a 50 gallon settling tank, where water from the spring fed lake is treated to remove any sediments (WOS 1999).

**5.5) Rearing facilities.**

The remaining flow from the lake is supplied to an 8' x 40' x 2.5' concrete raceway used for short term rearing. During 1999, three mesh-fabric net-pens each measuring 6' x 8' x 1.5' were suspended in the raceway to allow for division of different egg take groups. Beginning with brood year 2000, four 16' x 3' x 3' troughs were placed in the concrete raceway. The net-pens and troughs were covered with netting to avert avian predation (WOS 1999, 2000). Beginning with brood year 2000, some of the fry are transferred into two 8' x 8' floating net-pen structures in Port Townsend Bay supporting 4' deep, 1/8" stretch mesh containment nets.

**5.6) Acclimation/release facilities.**

At the appropriate release date, and upon reaching the desired fish release size, chum reared at the facility are bucketed into a 4' x 4' x 2.5' plastic tote filled with freshwater and aerated with regulated oxygen via air stone. The fish are trucked to a location in lower Chimacum Creek, transferred into buckets and hand-carried

for release above the estuarine area near the creek mouth (WOS 1999). Beginning with brood year 2000, some summer chum are released directly into Port Townsend Bay by lowering and inverting the saltwater net-pens.

**5.7) Describe operational difficulties or disasters that led to significant fish mortality.**

During rearing of brood year 1996, there was insufficient flow to some incubation trays due to a equipment/operation failure which resulted in the mortality of 15,000 alevin. A drain plug on a vertical tray dislodged and de-watered both that tray and the tray below it. That same year an outbreak of bacterial gill disease in ponded and incubating fish occurred. The initial loss was 3,000-4,000 fish. The alevin and fish were treated with a potassium permanganate drip regime. They were ponded early, fed at reduced rates, and released early. The subsequent higher mortalities due to sickness brought the egg to fry survival rate down to 58%. The high nutrient content of the water source which contributed to bacterial gill disease was assumed to be due to the hatchery's location downstream from active agricultural use. Concern about diminished water quality prompted the abandoning of that site for the current one beginning with brood year 1997.

Fry reared longer than four weeks in fresh water, particularly as the spring progresses, have developed fungal infection. The target size at release has been modified to 350-550 fpp from the original 450 fpp to provide for earlier releases, if needed. To further address this difficulty, beginning with brood year 2000, some fry will be reared in saltwater net-pens to reduce the loading at the freshwater rearing site.

**5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.**

Water used for incubation at Dungeness Hatchery is supplied by infiltration wells adjacent to the Dungeness River. The hatchery is supplied with an alarm system and back-up generator in the event of power failure, and is staffed full-time to allow rapid response to other factors, such as flooding, that could harm incubating eggs.

Water required for rearing at Naylor's Creek Hatchery is supplied by gravity flow from a spring-fed lake. Incubating and rearing eggs and fry will therefore not be affected by power failures. Combined intake systems can supply over 90gpm. No listed salmonids are present in the lake that could potentially be affected by the withdrawal method. The small volume of water used for the program does not affect flows available to listed salmonids, if any, that may be present in downstream areas.

The water intake consists of a 17"x 17" x 24" screened box of slotted aluminum

anchored with re-bar. A 2-inch PVC pipe enters the intake box near the base 1½ ft. from the average height of the pond surface. As the pond water level rises the surface area of the intake box increases. The intake unit is 6ft. from the pond bank. A walkway extends to the intake to allow for regular brooming of its surfaces.

The Naylor's Creek Hatchery is not staffed full time, but is checked at least once daily during operation and two or more times a day during high flows and/or severe cold weather events. The facility is armed with a battery powered audible alarm system. One of the crew members lives on the parcel of land upon which the hatchery site is located, two live less than a mile away which allows for rapid response to alarms. The back up water supply operates parallel to the primary line, an additional back up can be activated manually if the need arises. It consists of a conventional and/or battery powered bilge pump that can supply 5-7gpm flow from the raceway until correction of a water supply problem is made or further emergency measures can be instituted. Alarm, aeration supplementation, and back up water systems operate on conventional power with automatic conversion to 12-volt battery power, reducing the impact of power failures. The remoteness of the location provides additional security from potential vandalism of the water supply (WOS 1999).

Saltwater net-pens used to finish rearing are supplied with water through tidal flow. This site is monitored by trained crew members one or more times a day.

## **SECTION 6. BROODSTOCK ORIGIN AND IDENTITY**

**Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.**

### **6.1) Source.**

Broodstock used for the present reintroduction effort are collected at Salmon Creek; adults now returning to Chimacum Creek will be allowed to spawn naturally. It is the intention of the operators to collect adults returning to Chimacum Creek in future years, consistent with the SCSCI objective of using localized broodstock, when established and available, to complete reintroduction efforts. Eggs collected from adults returning to Chimacum Creek would replace or complement Salmon Creek egg transfers in the coming years.

Indigenous summer chum broodstock were first collected from Salmon Creek for the supplementation program in 1992. The project is now in its eighth year of operation, and the indigenous population, now of hatchery and natural lineage, continues to be used as broodstock.

## **6.2) Supporting information.**

### **6.2.1) History.**

The indigenous Chimacum Creek summer chum population was extirpated by the early 1980s, and was therefore designated as “extinct” by the Co-managers in the SCSCI (WDFW et al. 2000).

The founding Salmon/Snow summer chum stock, which includes fish returning to Salmon Creek and Snow Creek, was designated as “depressed” in status by the Co-managers in the SCSCI (WDFW et al. 2000). As a supplementation effort, the program is designed to increase the numbers of summer chum returning to Salmon Creek, resulting in recovery of the population; and to provide progeny of Salmon Creek stock to reintroduce a summer chum population to Chimacum Creek. Prior to initiation of the supplementation program, the stock was rated as at high risk of extinction. However, based on an increasing escapement trend and recent large escapements attributable in large part to the success of the hatchery program, the current extinction risk for this stock is low (WDFW et al. 2000).

### **6.2.2) Annual size.**

The number of broodstock collected is consistent with the guidelines in the SCSCI. The allowable broodstock collection number was initially set at 10 % of the total female summer chum return to Salmon Creek, to limit the effects of the removal of adult fish on abundance and diversity of the naturally spawning population. This limit was adjusted upward to 20 % of the total number of female summer chum returning to the watershed beginning in 1996. To achieve maximum release goals of 123,000 fed fry on Salmon Creek and 86,000 fed fry on Chimacum Creek, up to 240 adult summer chum (96 females and 144 males) will be collected. The use of broodstock in the supplementation program has already resulted in increased runsizes and natural escapements and changed the risk of extinction from “high” to “low” for this stock (WDFW et al. 2000).

### **6.2.3) Past and proposed level of natural fish in broodstock.**

Only summer chum indigenous to the Snow/Salmon stock have been used as broodstock. The project is now in its ninth year of operation, and the indigenous population, now of hatchery and natural lineage, continues to be used as broodstock. It is the intention of the program to collect adult returns to Chimacum Creek in future years, consistent with the SCSCI objective of using localized broodstock, when established and available to complete reintroduction efforts.

### **6.2.4) Genetic or ecological differences.**

The indigenous Snow/Salmon stock is the only source of broodstock. Hence, there are no known genotypic, phenotypic, or behavioral differences between the current supplementation stock and the natural stock, but it is being monitored.

#### **6.2.5) Reasons for choosing.**

The indigenous Chimacum Creek summer chum population was extirpated by the early 1980s, and was designated as “extinct” by the Co-managers in the SCSCI (WDFW et al. 2000). The indigenous Salmon/Snow summer chum stock was the geographically nearest donor stock, with similar timing and watershed size and characteristics. No special traits or characteristics were selected for in the broodstock within the indigenous Salmon/Snow stock.

#### **6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.**

The risk of among population genetic diversity loss will be reduced by selecting the geographically nearest indigenous summer chum salmon population for use as broodstock in the reintroduction program and limiting its use in only one watershed. The broodstock are collected randomly in a manner representative of the timing and magnitude of the return to the creek. No more than 20% of the total number of female summer chum returning to the watershed will be used as broodstock.

### **SECTION 7. BROODSTOCK COLLECTION**

#### **7.1) Life-history stage to be collected (adults, eggs, or juveniles).**

Adults

#### **7.2) Collection or sampling design.**

Summer chum adults are captured within the August 1 and October 31 adult migration period each year. Fish not retained for use as broodstock are released upstream of the trap site to spawn naturally. The trap is checked at least daily for captured fish, and more frequently during freshets. If it is determined that there is a risk to fish life, the trap will be opened to allow free passage of fish through the trap. As mentioned previously, the allowable broodstock collection number was initially set at 10 % of the total female summer chum return, to limit the effects of the removal of adult fish on abundance and diversity of the naturally spawning population. This limit was adjusted upward to 20 % of the total number of female summer chum returning to the watershed beginning in 1996. Summer chum broodstock are collected randomly as the fish arrive at the trap location, proportional to the timing, weekly abundance, and duration of the total return to the creek. The weir and fish trap are located in the lower reaches of the watershed, near the most downstream point of observed natural spawning activity. Less than 10 % of the total summer chum return has been observed to spawn downstream of the trap (WOS 1999, 2000). Nearly the entire summer chum return to the creek is available for trapping, decreasing the risk that fish trapped through the program are not representative of the total run.

### 7.3) Identity.

Only one summer chum population is present in Salmon Creek; otolith marking of fry and recovery of otoliths from adults will allow identification of hatchery and natural-origin fish in Salmon Creek. In addition, fry reared and released at Chimacum Creek will be uniquely otolith-marked beginning with brood year 1999; this will allow identification of hatchery and natural-origin fish in Chimacum Creek.

### 7.4) Proposed number to be collected:

#### 7.4.1) Program goal:

44 females plus 66 males for a total of 110 adults from Salmon Creek *or* Chimacum Creek. (A total of 96 females plus 144 males (240 adults) may be collected at Salmon Creek, of which 52 females plus 78 males for a total of 130 adults will be used for the Salmon Creek supplementation program).

#### 7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1988					
1989					
1990					
1991					
1992	27	35			
1993	23	29			
1994	12	12			
1995	18	35			
1996	50	59			
1997	50	60			
1998	56	65			
1999	31	34			
2000	65	71			

Data source: SCSCI (WDFW et al. 2000) and WDFW files. ([Link to appended Excel spreadsheet using this structure. Include hyperlink to main database](#))

**7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.**

The production of surplus eggs or fish is avoided to the extent feasible by limiting the number of adult summer chum secured through broodstock collection operations. Summer chum adults trapped in excess of program goals will be passed upstream to spawn naturally. Any surplus production will be treated in accordance with protocols set forth in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000).

**7.6) Fish transportation and holding methods.**

None proposed.

**7.7) Describe fish health maintenance and sanitation procedures applied.**

Fish health monitoring associated with adult fish used in the program is conducted through the WDFW Fish Health Division. The incidence of viral pathogens in summer chum broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the “Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998). Ovarian fluid, kidney, and spleen samples are collected from all fish spawned for evaluation by WDFW Fish Health Division staff for disease certification purposes.

**7.8) Disposition of carcasses.**

Broodstock from Salmon Creek are returned to Salmon Creek for nutrient enhancement. Once broodstocking begins in Chimacum Creek, carcasses will be returned to Chimacum Creek.

**7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.**

The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines. The indigenous population is the broodstock source. The multi-trait distribution of the broodstock closely matches the multi-trait distribution of the target population (similar spawn timing, size, appearance, age structure, etc.). The broodstock collection is technically and logistically possible.

## **SECTION 8. MATING**

**Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.**

### **8.1) Selection method.**

Summer chum broodstock are collected randomly as the fish arrive at the trap location, proportional to the timing, weekly abundance, and duration of the total return to the creek. The weir and fish trap are located in the lower reaches of the watershed, near the most downstream point of observed natural spawning activity. Less than 10 % of the total summer chum return has been observed to spawn downstream of the trap (WOS 1998). Nearly the entire summer chum annual return to the creek is available for trapping, decreasing the risk that fish trapped through the program are not representative of the total run.

### **8.2) Males.**

Use of backup males is not an integral part of the program, but may occur as a precautionary measure. Jacks will be used proportional to their abundance in the total return to the creek.

### **8.3) Fertilization.**

Summer chum adults collected at the Salmon Creek weir are spawned adjacent to the weir site. Eggs and milt collected from spawned fish are placed separately in dry, zip-locked bags, and chilled for transport by truck to Dungeness Hatchery (WOS 1998). Eggs will be fertilized at Dungeness Hatchery factorially, or using at least a 1:1 spawning ratio. Spawning protocols are done in accordance with the Co-Managers Fish Health Policy.

### **8.4) Cryopreserved gametes.**

None used.

### **8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.**

A factorial mating scheme or 1:1 individual matings will be applied to reduce the risk of loss of within population genetic diversity for the summer chum salmon population that is the subject of this supplementation program.

## **SECTION 9. INCUBATION AND REARING -**

**Specify any management goals (e.g. “egg to smolt survival”) that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.**

### **9.1) Incubation:**

#### **9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.**

Consistent with the SCSCI, the following survival rate objectives for each life stage will be applied to all programs; these rates will be used as criteria for measuring the effectiveness of each program:

<b>Chum Life Stage</b>	<b>% Survival by Life Stage</b>	<b>Cum. % Survival from Green Egg</b>
Green egg to eye-up	90.0 %	90.0 %
Eye-up to Swim-up	99.5 %	89.5 %
Swim-up to release	95.0 %	85.0 %

The following data on number of eggs and fry and survival rates by life stage for summer chum reared at Naylor’s Creek Hatchery is compiled from Wild Olympic Salmon annual reports (e.g., WOS 1999) and WDFW files as summarized in WDFW memo dated November 1, 2000:

<b>Brood year</b>	<b>Number of eggs or fry</b>					<b>% Survival by life stage</b>		
	<b>Total Green eggs</b>	<b>1/ Eyed eggs</b>	<b>Chimacum Creek Hatchery</b>			<b>Chimacum Creek Hatchery</b>		
			<b>Eyed eggs</b>	<b>Swim-up fry</b>	<b>Fry released</b>	<b>Green egg to eyed egg</b>	<b>Eyed egg to swim-up</b>	<b>Swim-up to release</b>
1996	----	114,900	50,000	31,243	29,000	----	62.5%	92.1%
1997	133,340	112,900	40,000	38,000	36,840	84.7%	95.0%	96.9%
1998	164,300	149,100	80,000	73,750	70,050	90.7%	92.2%	95.0%
1999	87,350	78,300	41,300	40,880	39,170	89.6%	99.0%	95.8%

1/ total includes eggs taken for both Salmon Creek supplementation and Chimacum Creek reintroduction programs.

#### **9.1.2) Cause for, and disposition of surplus egg takes.**

None anticipated. Any surplus production will be handled consistent with protocols in the SCSCI.

#### **9.1.3) Loading densities applied during incubation.**

Eggs and fry are incubated in vertical stack incubators at Dungeness Hatchery (to the eyed egg stage) and Naylor’s Creek (to swim-up). Beginning in 1999, summer chum eggs destined for the Chimacum program have been otolith marked while at Dungeness Hatchery. At Naylor’s Creek, eyed eggs are incubated and hatched in the incubator trays at a density of 2,000 - 10,000 per tray. The flow rate to the incubator is maintained at 2.5 - 3.5 gpm throughout the incubation period, which extends through late March.

#### **9.1.4) Incubation conditions.**

High quality well water source at Dungeness Hatchery and spring-fed source with settling basin at Naylor's Creek Hatchery pose low or /no siltation risk. Eggs are checked at eye-up and protected during tender stage (maintained in darkness, disturbance is avoided, etc.) Temperature regimes have posed no problems during operation of facilities. Fish are incubated at ambient water temperatures.

Temperature units (TUs) are monitored. 24 hour average temperatures are generally range from 38 to 44 degrees F. during incubation. The incubation units are housed within a building that can be heated to prevent freeze-up. Dissolved oxygen levels are mor

#### **9.1.5) Ponding.**

Fry from each egg take remain in incubators until 75% of fry are fully buttoned up at which time forced ponding occurs. Average weight at this time is about 1,250fpp.

Brood year	Eye-up		Ponding	
	Dates	TU (F)	Dates	TU (F)
1996	11/26-12/26	700-807	forced, 2/21-3/23	1541-1626
1997	11/19-12/19	599-732	forced, 2/23-3/21	1626-1675
1998	11/4-12/2	571-636	forced, 2/17-3/28	1590-1635
1999	11/15-12/20	726-793?	forced, 2/18-4/1	

#### **9.1.6) Fish health maintenance and monitoring.**

All summer chum are incubated under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager's Fish Health Policy (WDFW and WWTIT 1998). All eggs transferred from Salmon Creek for fertilization at Dungeness Hatchery are water hardened in an iodophore solution. Prior to eye-up, fungus in incubators is controlled by formalin drip. Eggs are shocked at eye-up to remove mortalities. At a different hatchery site on Chimacum Creek, bacterial gill disease problems in 1997 led to elevated mortality levels for 1996 brood summer chum that year; that site was not used again. At the Naylor's Creek facility, low dissolved oxygen levels of effluent water (recorded at 49% of saturation or approximately 5.0 ppm in 1998) has been of concern. Dissolved oxygen concentrations have been increased, however, through improvement in the amount of water and the header design used to introduce water to the raceway holding the net-pens. In addition, a more powerful electronic aerator has been installed in the clarifier barrel which now delivers 100% saturated water to the incubator.

#### **9.1.7) Indicate risk aversion measures that will be applied to minimize the**

## **likelihood for adverse genetic and ecological effects to listed fish during incubation.**

Eggs will be incubated using high quality water to minimize the risk of catastrophic loss due to siltation. All summer chum are incubated under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager's Fish Health Policy (WDFW and WWTIT 1998); see 9.1.6 above.

### **9.2) Rearing:**

#### **9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..**

The following data on number of eggs and fry and survival rates by life stage for summer chum reared at Naylor's Creek Hatchery is compiled from Wild Olympic Salmon annual reports (e.g., WOS 1999) and WDFW files:

Brood year	Green eggs	Number of eggs or fry				% Survival by life stage		
		Total 1/	Chimacum	Creek	Hatchery	Chimacum	Creek	Hatchery
		Eyed eggs	Eyed eggs	Swim-up fry	Fry released	Green egg to eyed egg	Eyed egg to swim-up	Swim-up to release
1996	----	114,900	50,000	31,243	29,000	----	62.5%	92.1%
1997	133,340	112,900	40,000	38,000	36,840	84.7%	95.0%	96.9%
1998	164,300	149,100	80,000	73,750	70,050	90.7%	92.2%	95.0%
1999	87,350	78,300	41,300	40,880	39,170	89.6%	99.0%	95.8%

1/ total includes eggs taken for both Salmon Creek supplementation and Chimacum Creek reintroduction programs.

#### **9.2.2) Density and loading criteria (goals and actual levels).**

Hatchery rearing densities will be those that yield the highest expected survivals. The following conservative "standard" and "maximum" pond loading densities will be applied in all proposed supplementation programs to promote the release of healthy, viable fish, as reported in the SCSCI:

Chum size	Pounds fish/gpm inflow		Pounds fish/ft <sup>3</sup> rearing volume	
	Standard	Max.	Standard	Max.
Swim-up	<1.0	1.5	0.5	0.75
1200-600/lb	1.0	2.5	1.0	2.0
600-400/lb	1.5	3.0	1.0	2.0

Actual loading rates are consistent with the SCSCI guidelines. Freshwater rearing net-pens or troughs are loaded with a maximum of 20,000 fish each and flows are maintained at approximately 20 gpm to each of four net-pens. At a target fish size of 450 fpp, this would be a loading of 2.2 pounds of fish per gpm inflow. At the

maximum program of 86,000 fry at 450 fpp, with 90 gpm available, maximum loading rate would be 2.1 pounds fish per gpm inflow. To date, the program has released a maximum of 70,050 fish at about 750 fpp, with 60 gpm inflow available, for a maximum loading rate of about 1.5 pounds fish per gpm inflow; this estimate is a maximum since fish were released on several dates and all fish were not on-site at the same time. Beginning with brood year 2000, to reduce loadings further, some fish are transferred to two 8' x 8' x 4' saltwater net-pens at about 1000 fpp where densities are maintained at < 0.3 pounds fish/ft<sup>3</sup> rearing volume.

### **9.2.3) Fish rearing conditions**

Fry are removed from incubators and ponded into net-pens in the rearing raceways at Naylor's Creek Hatchery upon absorption of the yolk sac. Lots are segregated during rearing by egg take date. Temperature regimes have posed no problems during operation of facilities. At Naylor's Creek facility, low dissolved oxygen levels of effluent water (recorded at 49 % of saturation or approximately 5.0 ppm in 1998) has been of concern. Dissolved oxygen concentrations are monitored periodically and have been increased through improvements in the amount of water and the header design used to introduce water to the raceway holding the net-pens or troughs. Saltwater net-pens are supplied with water through tidal flow.

### **9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.**

Biweekly weights, measuring fish per pound (fpp), are taken for pooled egg takes.

### **9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.**

Not collected, applicable, nor available. Fry are targeted for release at one gram average size to ensure that fry have sufficient energy reserves.

### **9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).**

At Naylor's Creek Hatchery, one to three days after ponding, feed is introduced to the fry via hand casting and 12-hour automatic spring driven belt feeders. Commercial feed at the rate of 2.0% to 2.5% per body weight per day is used. Freshwater rearing net-pens or troughs are loaded consistent with SCSCI guidelines for flows. Some fish are transferred to the saltwater net-pens in Port Townsend Bay within 1 to 2 weeks of ponding, after the fish have established feeding behaviour, at a size of about 1000 fpp. After transfer to saltwater, the feeding rate is increased to 5% BW/day. In both freshwater and saltwater, hand casting of feed over the water surface is done at least once a day to ensure all fish have exposure to feed. Sample weights to identify fish size and appropriate

feeding rates are taken every one to two weeks during the net-pen rearing period. Fish behavior and mortality is monitored daily to monitor the population for fish disease outbreaks.

**9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.**

All summer chum are reared under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager's Fish Health Policy (WDFW and WWTIT 1998). Fish are monitored daily during rearing for signs of disease, through observations of feeding behavior and monitoring of daily mortality trends. Preferred and maximum pond loading and feeding parameters are adhered to at all times, as specified in the SCSCI (WDFW et al. 2000). At Naylor's Creek Hatchery, fish have been treated via net-pen management strategies, including reduction in feeding levels and reduction of fish densities through early fish releases; and, each year, summer chum fry are examined by a WDFW fish health specialist within three weeks prior to release to determine fish health status.

As a precautionary measure, summer chum reared in the salt water net-pens in Port Townsend Bay are to be inoculated with a vibrio vaccine dip prior to transfer to saltwater. Each year summer chum fry in the saltwater net-pens are examined by a fish pathologist within three weeks prior to release to determine fish health status.

**9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.**

Not applicable.

**9.2.9) Indicate the use of "natural" rearing methods as applied in the program.**

Saltwater net-pens are used early in the development of fry, getting chum to seawater which is a natural life history strategy. Marine water flowing through the pens provides natural food.

**9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.**

Water required for rearing at Naylor's Creek is supplied by gravity flow through a slotted aluminum screened box in a spring-fed lake at a rate of approximately 60 gpm. No listed salmonids are present in the lake that could potentially be affected by the withdrawal method. The small volume of water used for the program does not affect flows available to listed salmonids, if any, that may be present in downstream areas. Listed summer chum reared in the project are protected by a parallel water system as well as a second back-up water supply, effected by a conventional and 12 volt battery array which supplies power to a sump pump located in the raceway. In addition, a battery-driven, audible alarm system is used to alert hatchery staff in the event of water supply failure. The remoteness of the location provides additional security from potential vandalism of the water supply (WOS 1998). Saltwater net-pens used to finish rearing are supplied with water

through tidal flow. Uniform rearing methods are applied across egg take groups. Fry are reared for 30 to 45 days which limits risk of domestication.

## **SECTION 10. RELEASE**

**Describe fish release levels, and release practices applied through the hatchery program.**

### **10.1) Proposed fish release levels.**

<b>Age Class</b>	<b>Maximum Number</b>	<b>Size (fpp)</b>	<b>Release Date</b>	<b>Location</b>
<b>Eggs</b>				
<b>Unfed Fry</b>				
<b>Fry</b>	86,000	350-550	March - May	Chimacum Creek; Port Townsend Bay
<b>Fingerling</b>				
<b>Yearling</b>				

### **10.2) Specific location(s) of proposed release(s).**

**Stream, river, or watercourse:** Chimacum Creek, WRIA 17.0203

**Release point:** Chimacum Creek, near mouth at about RM 0.1; Port Townsend Bay, from net-pens located ~ 1 mile NW of the mouth of Chimacum Creek

**Major watershed:** Chimacum Creek, Port Townsend Bay

**Basin or Region:** Admiralty Inlet, Puget Sound

### 10.3) Actual numbers and sizes of fish released by age class through the program.

Data is from SCSCI (WDFW et al. 2000) and WOS (1999, 2000). Beginning with brood year 2000, after 30 to 60 days of rearing in saltwater net-pens, and upon reaching an individual size of 1.0-1.5 grams, some summer chum will be released into Port Townsend Bay.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993								
1994								
1995								
1996								
1997			28,788	0.6 g				
1998			36,840	0.7 g				
1999			70,050	0.6 g				
2000			39,170	0.6 g				
Average			43,712	0.6 g				

Data source: SCSCI (WDFW et al. 2000) and WDFW files. ([Link to appended Excel spreadsheet using this structure. Include hyperlink to main database](#))

### 10.4) Actual dates of release and description of release protocols.

Released in freshwater near mouth of Chimacum Creek in the evening at or near high tide to mimic natural migrational characteristics for life stage; forced release; no culling.

Beginning with brood year 2000, some fry will be released from saltwater net-pens to mimic natural migrational characteristics for life stage at release; forced release, no culling; released by lowering and inverting pen during natural emigration period.

Release dates: 1997: March 23, May 9; 1998: March 27, April 11, April 19;  
1999: March 26, March 28, April 21; 2000: March 20, March 31, April 7, April 24

**10.5) Fish transportation procedures, if applicable.**

The fry are bucketed from the rearing raceway into a 4' x 4' x 2.5' plastic tote filled with freshwater aerated with regulated oxygen via air stone for transport to lower Chimacum Creek. The fish are then transferred into buckets and hand-carried down a pathway for release into Chimacum Creek above the estuarine area near the creek mouth at approximately RM 0.1; transport and release takes < 90 minutes. Beginning with brood year 2000, some fish will be transferred to saltwater net-pens for final rearing.

**10.6) Acclimation procedures**

Direct release from saltwater net-pens for some fish.

**10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.**

100% otolith-marked beginning with 1999 brood year releases

**10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.**

None anticipated. Any surplus production will be handled consistent with protocols in the SCSCI.

**10.9) Fish health certification procedures applied pre-release.**

Examination by WDFW fish pathologist prior to release.

**10.10) Emergency release procedures in response to flooding or water system failure.**

If fish are at the eyed egg and/or alevin stage, regulated oxygen can be administered directly into the clarifier barrel via an airstone. If fish are developed to the fry stage and ponded, a transport tote and regulated oxygen are available for immediate transport to the release site.

**10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.**

The fry are released in the evening, near or at a high tide, to minimize the incidence of avian and fish predation. Fed fry are released that will maximize survival and minimize the risk of interaction with wild summer chum fry that adhere to nearshore waters during the time of 1.0 gram chum fry release.

## **SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS**

### **11.1) Monitoring and evaluation of “Performance Indicators” presented in Section 1.10.**

#### **11.1.1) Describe plans and methods proposed to collect data necessary to respond to each “Performance Indicator” identified for the program.**

It is planned that all “Performance Indicators” identified in Section 1.10 will be monitored and evaluated.

To date, the following “Performance Indicators” **addressing benefits** have monitored for the Chimacum Creek summer chum reintroduction program:

#### **Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.**

1. Differentially mark all hatchery-origin summer chum fry to allow for distinction from natural-origin fish upon return as adults on the spawning grounds. This will be accomplished by otolith (thermal) marking or another permanent, effective method.
2. Conduct spawning ground surveys throughout the summer chum return to enumerate spawners, and to collect age class composition through scale sampling. In addition, WOS and NOSC volunteers are identifying redd locations and intra-gravel dissolved oxygen in the spawning area to help evaluate and remedy the effects of degraded stream habitat in the Chimacum watershed.

To date, the following “Performance Indicators” **addressing risks** have monitored for the Chimacum Creek summer chum reintroduction program:

#### **Element 3: Determine the need, and methods, for improvement of supplementation or reintroduction operations or, if warranted, the need to discontinue the program.**

1. Determine the pre-spawning and green egg to released fry survivals for each program at various life stages.
  - a. Monitor growth and feed conversion for summer chum fry.
  - a. Determine green egg to eyed egg, eyed egg to swim-up fry, and swim-up fry to released fry survival rates for summer chum.
  - a. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for chum broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for fed fry.

- a. Summarize results of tasks for presentation in annual reports.
- a. Identify where the supplementation program is falling short of objectives, and make recommendations for improved fry production as needed.
- 2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.
  - a. Monitor operation of adult trapping operations, ensuring compliance with established broodstock collection protocols for each station.
  - b. Monitor timing, duration, composition, and magnitude of each run at each adult collection site.
  - c. Maintain daily records of trap operation and maintenance, number and condition of fish trapped
  - d. Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible.
  - e. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.
- 3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW (or USFWS for federal agency operations) will monitor fish health.
  - a. Fish health monitoring will be conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.
  - b. The incidence of viral pathogens in summer chum broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the “Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998).
  - c. Recommendations on fish cultural practices will be provided on a monthly basis, based upon the fish health condition of chum fry.
  - d. Fish health monitoring results will be summarized in an annual report.

**11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

Funding, staffing, and support are available and committed for current Monitoring and Evaluation. Additional funds may be needed to support allozyme, DNA, and otolith analysis.

**11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.**

It is anticipated that adherence to monitoring and evaluation protocols in the SCSCI will not elevate risk to listed summer chum. Listed chinook salmon are not present in the Chimacum watershed and will not likely be affected by the program.

## **SECTION 12. RESEARCH**

*Provide the following information for any research programs conducted in **direct association with the hatchery program described in this HGMP**. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in **Table 1**.*

Not applicable to this program. Research currently underway or planned for similar summer chum supplementation projects at Big Beef Creek and Quilcene National Fish Hatchery will provide valuable information regarding the effects and success of chum supplementation programs and be applicable here. Research may be proposed in the future at Chimacum Creek.

**12.1) Objective or purpose.**

Not applicable

**12.2) Cooperating and funding agencies.**

Not applicable

**12.3) Principle investigator or project supervisor and staff.**

Not applicable

**12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.**

Not applicable

**12.5) Techniques: include capture methods, drugs, samples collected, tags applied.**

Not applicable

**12.6) Dates or time period in which research activity occurs.**

Not applicable

**12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.**

Not applicable

**12.8) Expected type and effects of take and potential for injury or mortality.**

Not applicable

**12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached “take table” (Table 1).**

Not applicable

**12.10) Alternative methods to achieve project objectives.**

Not applicable

**12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.**

Not applicable

**12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.**

Not applicable

### **SECTION 13. ATTACHMENTS AND CITATIONS**

*Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.*

#### **Attachment**

WDFW memo dated November 1, 2000.

#### **Citations**

Allendorf, F.W., D. Bayles, D.L. Bottom, K.P. Currens, C.A. Frissell, D. Hankin, J.A. Lichatowich, W. Nehlsen, P.C. Troter, and T.H. Williams. 1997. Prioritizing Pacific salmon stocks for conservation. *Conservation Biology* Vol. 11 No. 1 p. 140-152.

Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. Olympia. 212 p.

Washington Department of Fish and Wildlife. 1996. Fish health manual. Hatcheries Program, Fish Health Division, Washington Dept. of Fish and Wildlife, Olympia. 69 p.

Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes. 1998. Co-managers of Washington fish health policy. Fish Health Division, Hatcheries Program. Washington Dept. of Fish and Wildlife, Olympia.

Washington Department of Fish and Wildlife and Point-No-Point Treaty Tribes. 2000. Summer Chum Salmon Conservation Initiative. Hood Canal and Strait of Juan de Fuca Region. Jim Ames, Chris Weller, Gary Graves, editors. Fish Program, Washington Department of Fish and Wildlife, Olympia.

Wild Olympic Salmon. 1999. Salmon Creek and Chimacum Creek summer chum salmon restoration projects. 1998-99 annual report. 7 pp. plus attachments.

Wild Olympic Salmon. 2000. Salmon Creek and Chimacum Creek summer chum salmon restoration projects. 1999-2000 annual report. 22 pp. plus attachments.

## **SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY**

“I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

Name, Title, and Signature of Applicant:

Thom H. Johnson, WDFW, District Fish Biologist

Certified by \_\_\_\_\_ Date: February 28, 2000

**Attachment to HGMP for Chimacum Creek summer chum reintroduction program**

**WASHINGTON DEPARTMENT OF FISH AND WILDLIFE**

**Fish Program - Region 6**

*Hood Canal District , 283236 Highway 101, Port Townsend, WA 98368*

*Phone (360) 765-3979 FAX (360) 765-4455 e-mail JOHNSTHJ@dfw.wa.gov*

November 1, 2000

TO: Summer Chum Supplementation Workgroup: Jim Ames, WDFW; Tom Kane, USFWS, Chris Weller, PNPTC;  
Ginna Correa, WDFW; Tom Ammeter, Paula Mackrow, North Olympic Salmon Coalition; Jim Hackman, Wild Olympic Salmon

FROM: Thom H. Johnson

SUBJECT: **Survival Rates by Life Stage for Summer Chum Salmon Reared in the Supplementation Program at Salmon Creek and the Reintroduction Program at Chimacum Creek**

The Summer Chum Salmon Conservation Initiative (SCSCI) and the Hatchery and Genetic Management Plans (HGMPs) prepared for the Salmon Creek and Chimacum Creek programs establish survival rate objectives during incubation and rearing.

The following survival rate objectives for each life stage are applied to all programs; these rates are used as criteria for measuring the effectiveness of each program:

<b>Chum Life Stage</b>	<b>% Survival by Life Stage</b>	<b>Cum. % Survival from Green Egg</b>
Green egg to eye-up	90.0 %	90.0 %
Eye-up to Swim-up	99.5 %	89.5 %
Swim-up to release	95.0 %	85.0 %

The Salmon Creek and Chimacum Creek summer chum programs have generally been successful in meeting the survival rate objectives. The number of eggs, swim-up fry, and fry released and the survival rates by life stage for summer chum reared in the supplementation program at Salmon Creek Hatchery from 1992 through 1999 and in the reintroduction program at Chimacum Creek Hatchery from 1996 through 1999 are presented Table 1 and Table 2, respectively.

cc: Tim Flint, WDFW  
Travis Nelson, WDFW  
Jeffrey Haymes, WDFW  
Jeff Grimm

Steve Schroder, WDFW  
Cheri Scalf, WDFW  
Tim Tynan, NMFS  
Derek Poon, NMFS

file: \\region7\sum-chum\LifeStage-survivalrates.wpd

Table 1. Number of eggs, swim-up fry, and fry released and the survival rates by life stage for summer chum salmon reared in the supplementation program at Salmon Creek Hatchery, 1992 through 1999 brood years.

Brood year	Number of eggs or fry					% Survival by life stage			Cumulative % survival		
	Total a/		Salmon Creek Hatchery			Salmon Creek Hatchery			Salmon Creek Hatchery		
	Green eggs	Eyed eggs	Eyed eggs	Swim-up fry	Fry released	Green egg to eyed egg	Eyed egg to swim-up	Swim-up to release	Green egg to swim-up	Green egg to release	Eyed egg to release
1992	46,980	44,280	44,280	18,684	19,200	94.3%	42.2%	100.0%	39.8%	39.8%	43.4%
1993	----	46,300	46,300	26,837	44,000	----	58.0%	100.0%	----	----	95.0%
1994	----	24,200	24,200	2,000	2,000	----	8.3%	100.0%	----	----	8.3%
1995	41,750	39,200	39,200	38,808	38,808	93.9%	99.0%	100.0%	93.0%	93.0%	99.0%
1996	----	114,900	64,900	62,300	62,000	----	96.0%	99.5%	----	----	95.5%
1997	133,340	112,900	72,900	71,011	71,821	84.7%	97.4%	100.0%	82.5%	82.5%	98.5%
1998	164,300	149,100	69,100	68,423	67,807	90.7%	99.0%	99.1%	89.9%	89.1%	98.1%
1999	87,350	78,300	29,200	28,950	28,400 b/	89.6%	99.1%	98.1%	88.9%	87.2%	97.3%

a/ Total includes eggs taken for both Salmon Cr. supplementation and Chimacum Cr. reintroduction programs; all green eggs are incubated at Dungeness Hatchery and shipped as eyed eggs to Salmon Cr. Hatchery and Chimacum Cr. Hatchery

b/ Does not include 6300 fish transferred on June 1 at 256 fpp from Dungeness H. and 6280 fish released on June 12 at 175 fpp at R.M. 0.1 in Salmon Creek after rearing in freshwater there; total release was 34,680 fish for BY 1999.

Table 2. Number of eggs, swim-up fry, and fry released and the survival rates by life stage for summer chum salmon reared in the reintroduction program at Chimacum Creek Hatchery, 1996 through 1999 brood years.

Brood year	Number of eggs or fry					% Survival by life stage			Cumulative % survival		
	Total a/		Chimacum Creek Hatchery			Chimacum Creek Hatchery			Chimacum Creek Hatchery		
	Green eggs	Eyed eggs	Eyed eggs	Swim-up fry	Fry released	Green egg to eyed egg	Eyed egg to swim-up	Swim-up to release	Green egg to swim-up	Green egg to release	Eyed egg to release
1996	----	114,900	50,000	31,243	28,788	----	62.5%	92.1%	----	----	57.6%
1997	133,340	112,900	40,000	38,000	36,840	84.7%	95.0%	96.9%	80.4%	78.0%	92.1%
1998	164,300	149,100	80,000	73,750	70,050	90.7%	92.2%	95.0%	83.7%	79.5%	87.6%
1999	87,350	78,300	41,300	40,880	39,170	89.6%	99.0%	95.8%	88.7%	85.0%	94.8%

a/ Total includes eggs taken for both Salmon Cr. supplementation and Chimacum Cr. reintroduction programs; all green eggs are incubated at Dungeness Hatchery and shipped as eyed eggs to Salmon Cr. Hatchery and Chimacum Cr. Hatchery

Table 1. Estimated listed salmonid take levels by hatchery activity.

Listed species affected: <u>Summer chum salmon</u> ESU/Population: <u>Hood Canal Summer Chum ESU / Chimacum Creek</u> Activity: <u>Reintroduction</u>				
Location of hatchery activity: <u>Dungeness Hatchery/ Naylor's Creek Hatchery</u> Dates of activity: <u>August - May</u> Hatchery program operator: <u>WDFW, Wild Olympic Salmon</u>				
Type of Take	Annual Take of Listed Fish By Life Stage ( <i>Number of Fish</i> )			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			500	300
Collect for transport b)				
Capture, handle, and release c)			1,417	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)			53	
Intentional lethal take f)			30	
Unintentional lethal take g)				
Other Take (specify) h)				

- a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.  
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.  
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.  
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.  
e. Listed fish removed from the wild and collected for use as broodstock.  
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.  
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild.  
h. Other takes not identified above as a category.

**Instructions:**

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.